

(12) UK Patent Application (18) GB (11) 2 137 068A

(43) Application published 3 Oct 1984

(21) Application No 8406718

(22) Date of filing 15 Mar 1984

(30) Priority data

(31) 8307839 (32) 18 Mar 1983 (33) GB

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(51) INT CL³
A24D 3/04

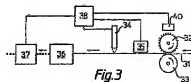
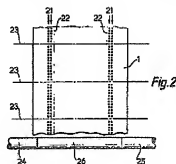
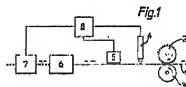
(52) Domestic classification
A2C 28

(56) Documents cited
None

(58) Field of search
A2C

(54) Cigarette Manufacture

(57) Apparatus for making ventilated cigarettes, includes a first perforator 2, 3 which is not readily susceptible to control and is arranged to perforate the tipping paper 1 by which cigarettes 25 are joined to filter portions 26, or to perforate the completed filter cigarettes; a controllable perforator 4 arranged to form additional perforations 22 in the tipping paper prior to assembly of the filter cigarettes; and control means 8 arranged to control the controllable perforator in response to a porosity measuring device 5 and/or in response to a cigarette dilution testing device 7.

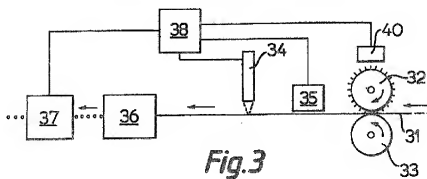
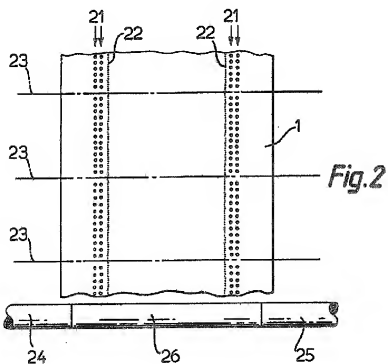
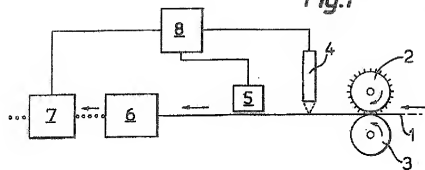


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Fig.1



SPECIFICATION Cigarette Manufacture

This invention is concerned with the manufacture of ventilated filter cigarettes, which are cigarettes having ventilation side holes near their mouth ends through which the smoker draws in air from the atmosphere which dilutes the cigarette smoke.

- A problem associated with producing ventilated cigarettes is that of maintaining the mean dilution and the standard deviation within acceptable limits. One way of producing ventilated cigarettes involves perforating the tipping paper which joins the cigarette (tobacco portion) to the filter. Another way involves perforating the completed filter cigarettes. Examples of such systems using perforating pins are described respectively in British patent specifications Nos. 2055689 and 1564219. However, with both these systems it is difficult to control the ventilation adequately.
- According to the present invention there is provided a method of forming ventilated cigarettes in which each completed cigarette or the tipping paper is perforated by means of a first perforator (preferably employing pins) which is not readily susceptible to control; and additional perforations are formed in the tipping paper by means of a controllable perforator which is controlled in response to a porosity measuring device (in the event that the first perforator perforates the tipping paper) and/or in response to a cigarette dilution testing device.

- The controllable perforator is preferably a laser which may, for example, be pulsed at a frequency depending upon the number of additional perforations it is required to form in the tipping paper. Alternatively, a spark perforator may be used, but it would be particularly important in that case to form the additional perforations well away from the initial perforations since the sparks would otherwise tend to pass through the initial perforations and thus not form (or not do so reliably) additional perforations.

- It should be understood that the expression "porosity measuring device" in this context refers to a device for measuring the porosity of the tipping paper resulting from the initial perforations. The cigarette dilution testing device, which may for example be as described in British patent specification No. 2050804, tests the dilution characteristic of the completed cigarettes.

- If the first-mentioned perforator is arranged to perforate the tipping paper before assembly of the cigarettes, the control means for controlling the controllable perforator is preferably arranged to adjust the controllable perforator rapidly in response to changes in the porosity of the tipping paper (as indicated by a porosity measuring device) and to adjust the controllable perforator in response to changes in cigarette dilution in a progressive (gradual) manner.

Examples of systems according to this

invention are shown in the accompanying drawings. In these drawings:

- Figure 1 is a schematic view showing the perforators, a filter assembly machine and a cigarette testing device;
Figure 2 is a plan view showing the perforation pattern applied to the tipping paper; and
Figure 3 is a schematic view of an alternative arrangement of the perforators and testing devices.
- A system is shown in Figure 1 in which cigarette tipping paper 1 is fed between rollers 2 and 3 to form initial rows of perforations. For that purpose, the roller 2 carries pins which form, in cooperation with the roller 3, two parallel tracks of perforations, each track comprising in this example two rows 21 (Figure 2). The tipping paper then passes two lasers 4 which add rows 22 of fine perforations, and then passes a porosity measuring device 5 which measures the porosity of the tipping paper in the region of each of the perforated areas. The operation of the porosity measuring device 5 is, for example, pneumatic (measuring the pressure drop through the tipping paper) or optical.
- A filter assembler 6 cuts the tipping paper along transverse lines 23 to form separate portions each of which is then wrapped around an assembly comprising two cigarettes 24 and 25 with an interposed double filter portion 26. A disc knife in the filter assembler 6 then cuts the double filter cigarette assemblies through the middle to form individual filter cigarettes which are conveyed through a cigarette testing device 7.
- Operation of the lasers 4 to determine the total additional area of the perforations added in each row 22 is controlled by a control circuit 8. This may be arranged to provide a quick response to changes in the porosity measured by the porosity measuring device 5, subject to long-term control in response to the cigarette testing device 7.
- The control circuit may be generally as described in our British patent specification No. 2121669. That is to say, it is arranged to control the perforator in response to a comparison between the porosity measurement and a reference signal; the cigarette testing device is arranged to emit a correction signal whenever the dilution departs from a predetermined level, the correction signal being arranged to alter the reference level of the porosity measuring device, preferably in a progressive manner. In this context, the expression "progressive manner" is intended to denote an arrangement in which the reference level is changed relatively slowly; in contrast, the porosity measuring device is preferably arranged to change the operation of the perforator relatively quickly when it detects a change in the porosity of the web, for example resulting from change in the web velocity while the machine is being started up or shut down.
- In a preferred arrangement, the cigarette testing device is arranged to control the reference signal via an up-down counter. Thus, a change of

the cigarette dilution in any particular direction produces a small stepped change in the reference signal, such changes occurring in response to a count which preferably corresponds to the passage of cigarettes through the machine; that is to say, is related to the speed of operation of the machine.

An alternative system is shown in Figure 3 in which components which are similar to components in Figure 1 has the same reference numeral with 30 added. In this arrangement the porosity of the tipping paper 31 is measured before the paper is perforated by the laser 34. In this way the porosity of the paper is "topped up" to a reference value after its porosity has been measured. The operation of the laser is also controlled in response to the speed of the web which is measured by means of a tachometer 40.

Each of the lasers 4 may comprise a pulsed laser, for example one made by Ferranti PLC and known as type C11 1034. Control of the laser may be in relation to the frequency of pulsing, the energy released in each pulse, or by combination of these factors. The pulsing may be controlled cyclically so that, instead of being continuous, each row 22 may consist of successive spaced sections corresponding to successive portions of the tipping paper, the length of each spaced section being possibly controllable.

It should be noted that the rollers 2, 3 and 32, 33 are driven at equal speeds and are timed so that the cut lines at positions 23 pass between successive pin perforations as described in our British patent specification No. 2055669. On the other hand, the rows of finer perforations 22 may be continuous.

The use of two separate lasers 4 or 34 allows separate control of the additional perforations produced by the two lasers to compensate for any differences in the operation of the two sets of pins. However, as an alternative, a single laser may be used with a beam splitting device to produce the two rows of fine perforations.

Another possibility is that there may be two separate lasers, as described above, each of which has its output beam split to produce two or more rows of fine perforations.

In principle the laser perforations in each track may be on either side of the row or rows of pin perforations, or may lie between two rows of pin perforations. However, it is preferable for the laser perforations to be separated from the pin perforations by at least 1 mm in order for the laser perforations to have substantially their maximum effect on the dilution of the completed cigarettes.

CLAIMS

1. A method of forming ventilated cigarettes in which each completed cigarette or the tipping paper is perforated by means of a first perforator which is not readily susceptible to control; and additional perforations are formed in the tipping paper by means of a controllable perforator which

is controlled in response to a porosity measuring device and/or in response to a cigarette dilution testing device.

2. A method according to claim 1 in which the first-mentioned perforations are formed in the tipping paper and in which the porosity of the web is measured after the formation of the first perforations but before the formation of the additional perforations.

3. A method according to claim 2 in which the controllable perforator is also controlled in response to the speed of the tipping paper.

4. Apparatus for making ventilated cigarettes, including first perforator which is not readily susceptible to control and is arranged to perforate the tipping paper by which cigarettes are joined to filter portions, or to perforate the completed filter cigarettes; a controllable perforator arranged to form additional perforations in the tipping paper prior to assembly of the filter cigarettes; and control means arranged to control the controllable perforator in response to a porosity measuring device and/or in response to a cigarette dilution testing device.

5. Apparatus according to claim 4 in which the first perforator is a mechanical perforator.

6. Apparatus according to claim 5 in which the first perforator comprises pins.

7. Apparatus according to any one of claims 4 to 6 in which the controllable perforator is a laser perforator.

8. Apparatus according to claim 7 in which the laser perforator is arranged to emit pulses of laser radiation.

9. Apparatus according to claim 8 in which the frequency of the pulses is controlled in response to the porosity measuring device and/or in response to the cigarette dilution testing device.

10. Apparatus for producing ventilated cigarettes, comprising means for transporting a web of cigarette tipping paper to a cigarette assembly machine; a first perforator which is not readily susceptible to control and is arranged to perforate a first region of the web; a controllable perforator arranged to perforate a second region of the web; means for measuring the porosity of the web after it has been perforated by both the first perforator and the controllable perforator or after it has only been perforated by the first perforator; means for measuring the dilution of cigarettes assembled by the assembly machine which include sections of the perforated web; and control means for controlling the controllable perforator in response to the measured porosity and in response to the measured dilution.

11. Apparatus according to claim 10 in which the control means is arranged to adjust the controllable perforator rapidly in response to changes in the web porosity and is arranged to adjust the controllable perforator in response to changes in cigarette dilution in a progressive manner.

12. A method substantially in accordance with
any one of the examples described with reference
to the accompanying drawings.

13. Apparatus substantially in accordance with
5 any one of the examples described with reference
to the accompanying drawings.

Printed in the United Kingdom for Her Majesty's Stationery Office, Demand No. 8818035, 10/1984, Contractor's Code No. 6378.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.